GIS & QA: The Phantom Menace

Region 6, U.S. Environmental Protection Agency

David A. Parrish
(214) 665-8352
parrish.david@epa.gov

GIS & QA: Overview

- ✓ What is a GIS?
- ✓ GIS/QA Authorities
- ✓ NSDI/FGDC
- ✓ EPA & LDIP
- ✓ QA Measures for GIS
- ✓ Next Steps for QA/GIS

GIS & QA: WHAT IS A GIS?

… , a GIS is a computer system capable of assembling, storing, manipulating, and displaying geographi-cally referenced information , i.e. data identified according to their locations. Practitioners also regard the total GIS as including operating personnel and the data that go into the system.

GIS & QA: AUTHORITIES

- ✓ ***EXECUTIVE ORDER 12906,*** COORDINATING GEOGRAPHIC DATA ACQUISITION AND ACCESS: THE NATIONAL SPATIAL DATA INFRASTRUCTURE
- ✓ ***OMB CIRCULAR A-16,*** Revised Coordination of Surveying, Mapping, and Related Spatial Data Activities
- ✓ **EPA IRM POLICY MANUAL 2100 CHAPTER 13** - LOCATIONAL DATA
- ✓ **EPA Order 5360.1 CHG 1 (1998),** *Policy and Program Requirements for the Mandatory Agency-wide Quality System*

GIS & QA: NSDI/FGDC

- ✓ Established by Executive Order 12906 & OMB Circular A-16 Revised
- ✓ National Spatial Data Infrastructure (NSDI)
- ✓ Federal Geographic Data Committee (FGDC)
  - ✓ Establishes Leadership & Direction for geospatial (or GIS) data activities within the Federal government

GIS & QA: NSDI/FGDC

BASIC COMPONENTS of NSDI

- Standards
- Metadata
- Clearinghouse
- Framework
- Partnerships & Grants Program

GIS & QA: NSDI/FGDC

Content Standard for Digital Geospatial Metadata - Major Uses

- ✓ Maintain internal investment
- ✓ Provide information on holding to others
- ✓ Information to process & interpret data.

GIS & QA: NSDI/FGDC

Content Standard for Digital Geospatial Metadata - Major Roles

- ✓ Availability
- ✓ Fitness for use
- ✓ Access
- ✓ Transfer

GIS & QA: NSDI/FGDC

Geospatial Metadata - Mandatory Sections

- Identification Information
- ***Data Quality Information***
- Spatial Data Organization Information
- Spatial Reference Information
- Entity and Attribute Information
- Distribution Information
- Metadata Reference Information

GIS & QA: NSDI/FGDC

Geospatial Metadata - Data Quality Info.

- Attribute Accuracy
- Logical Consistency Report
- Completeness Report
- ***Positional Accuracy***
- Lineage
- (Cloud Cover) -optional element

GIS & QA: EPA & LDIP

BACKGROUND

- All major Data Systems handle Lat/Long
- Some have initiated QA activities
- EPA GIS Staff Activities
  - Integration of Points from Multiple Sources
  - Locational Data Policy & Goal
  - Document AML
  - **M**ethod, **A**ccuracy & **D**escription Codes

GIS & QA: EPA & LDIP

EPA's Locational Data Policy (LDP):

Establishes principles for collecting and documenting lat/long coordinates for facilities, sites, and monitoring observation points.

GIS & QA: EPA & LDIP

EPA LRS/MAD CODES

- ✓ Facilitate the integration of data into GIS's and statistical mapping programs
- ✓ Standardize coding of geographic coordinates & associated attributes
- ✓ Required & Optional Data Elements.
- ✓ Basis of Latitude/Longitude Data Standard.

GIS & QA: EPA & LDIP

Mandatory MAD Data Elements:

- ✓ Latitude Measure
- ✓ Longitude Measure
- ✓ Horizontal Collection Method
- ✓ Horizontal Accuracy Measure
- ✓ Reference Point
- ✓ Horizontal Reference Datum
- ✓ Source Map Scale

GIS & QA: EPA & LDIP

LOCATIONAL DATA IMPLEMENT-ATION PROJECT(LDIP) *GOAL*-

- ✓ Develop a repository for locational data
- ✓ Generate a latitude/longitude of **documented origin** for all EPA "entities"
- ✓ Use existing data sources & build capacity
- ✓ **Target accuracy** of +/- 25 meters

GIS & QA: EPA & LDIP

LDIP Phase I Summary

- ✓ Focus: Quantity and repository
- ✓ Developed Locational Reference Tables in Envirofacts
- ✓ Address matched 1 million points from EPA Program systems

GIS & QA: EPA & LDIP

LDIP Phase II Summary

- ✓ Focus: fill data gaps & improve quality
- ✓ Resources provided to support LDIP/LRT
- ✓ Regional, State & EPA/HQ in project plan
- ✓ All five States in Region 6

GIS & QA: EPA & LDIP

Other EPA NSDI/FGDC ACTIVITIES

- Geospatial Metadata Clearinghouse
  - Offices Created FGDC Metadata
  - EPA Website NOT FGDC Compliant
  - Remedy (?)- Environmental Information Management System (EIMS)
- Standards -EPA is on work groups
- Public Access:
  - ***EnviroFacts & EnviroMapper***

GIS & QA: EPA & LDIP

http://www.epa.gov/enviro

GIS & QA: MEASURES

ACCURACY

- EPA LRS- Accuracy - Meters
- FGDC National Standard for Spatial Data Accuracy (NSSDA)
  - Test Guidelines.
  - Reporting.
  - Relationship to other Standards.

GIS & QA: MEASURES

ACCURACY

SCALE

DOES

MATTER!

GIS & QA: MEASURES

ACCURACY - Very Small Scale

GIS & QA: MEASURES

ACCURACY - Small Scale

GIS & QA: MEASURES

ACCURACY - Medium Scale

GIS & QA: MEASURES

ACCURACY - LARGE SCALE

GIS & QA: MEASURES

ACCURACY - PREFFERED TEST

Independent source of higher accuracy.

- Root-mean-square error.
- 95% confidence level.
- Minimum of 20 check points.

GIS & QA: MEASURES

Independent Sources in Order of Accuracy

- National Spatial Reference System or Professional Survey
- Global Positioning System or Digital Orthophoto Quads.
- USGS Quad Maps (1:24,000)
- TIGER files or Address Matching
- Satellite Imagery (Landsat, SPOT)

GIS & QA: MEASURES

Accuracy Test Example - Horizontal Accuracy

Evaluation Data Set: LDIP Address Matching Points from Envirofacts LRT
Independent Source of High Accuracy: Border GPS Survey Texas Bureau of Economic Geology
Check Points = 20
Projection: National Lambert Meters (NAD 1983)
Geographic Area: Brownsville, TX to Las Cruces, NM
Difference in x Range (absolute value); 8 - 669 meters
Difference in y Range (absolute value); 8 - 1,090 meters
RMSE (x) = 187
RMSE (y) = 257
Accuracy = 2.4477 * 0.5 * (RMSE(x) + RMSE(y)) = **544**
Reporting:
Tested 544 meters horizontal accuracy at 95% confidence level

GIS & QA: MEASURES

ACCURACY - Alternative Means

✓Deductive Estimate
- ✓LRT rule of thumb

✓Internal Evidence

✓Comparison to Source
- ✓Common when source is thematic maps.

GIS & QA: MEASURES

OTHER MEASURES

✓**Representativeness** - *Description* Code
- ✓What is this point?
- ✓Extensive list of feature

✓**COMPARABILITY**- *Datum* Code

✓**COMPLETENESS**- FGDC Standard.
- Some sites are difficult to locate.
- Region 6 Strategy- risk based tactics.

- **Verification LRS/MAD Code**

GIS & QA: MEASURES

***MAD* Codes for Representativeness:**

***Description* Code**
- What is this point?
- Extensive feature list

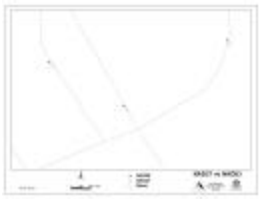
***Verification* Code**

GIS & QA: MEASURES

***MAD* Codes for COMPARABILITY :**

Horizontal Datum Code
- North American Datum 1927 (NAD27)

North American Datum 1983 (NAD83)



GIS & QA: MEASURES

COMPLETENESS- FGDC Standard.

Region 6 Risk Based Strategy- Based on relative risk level, priority is given to locating those sites that pose the greatest risk

GIS & QA: NEXT STEPS

NATIONAL
- QA/GIS Work Group - Training & Guidelines
- Establish NSDI Clearinghouse Node (EIMS)
- Continue LDIP Phase 2.
- Finalized Locational Reference Standard & Business Rules.

GIS & QA: NEXT STEPS

REGIONAL
- Draft a Region 6 GIS Program QAPP.
- Develop a guidance for GIS QAPPs under grants/contracts.
- Assist States/Tribes with GIS QA.

GIS & QA: WEBSITES

REFERENCE WEBSITES
- ✓ EPA Region 6 GIS - http://www.epa.gov/region6/gis/
- ✓ EnviroFacts (http://www.epa.gov/enviro)
- ✓ Federal Geographic Data Committee - http://www.fgdc.gov
- ✓ EPA Quality Assurance Program - http://es.epa.gov/ncerqa/qa/
- ✓ EPA Locational Data Improvement Project - http://www.epa.gov/enviro/html/ldip/